Denitrification Triggered by Extracellular Electron Transfer

T. YAMADA[1], S. KAWAICHI[2], N. MATSUSHITA[1], R. NAKAMURA[2*]

[1]Materials and Structures Laboratory, Tokyo Institute of Technology, 4259 Midori, Nagatsuta, Yokohama 226-8503, Japan

[2]Biofunctional Catalyst Research Team, RIKEN Center for Sustainable Resource Science, 2-1 Hirosawa, Wako, Saitama 351-0198, Japan (*correspondence: ryuhei.nakamura@riken.jp)

Nitrogen Cycle and Microbial Activities

Nitrogen cycle is indispensable for all lives because proteins and nucleic acids are composed of nitrogen. Nitrogen has various oxidation state and the redox reactions were mediated by microorganism's activities. Denitrification is the reaction to return fixed nitrogen to nitrogen gas, which is important to complete the nitrogen cycle [1]. It is reported that some denitrifiers can oxidize Fe^{2+} and reduce nitrate [2]. This report indicates that nitrogen cycle and iron cycle are coupled through microbial metabolism.

In this study, we investigated extracellular electron transfer (EET) of *Pseudomonas stutzeri*, a model organism for denitrification, and monitored the metabolic switching from lithotroph to mixotroph by electrochemical technique. Electrochemical cultivation of *P. stutzeri* in a lithotrophic medium with Fe^{2+} generated a weak, but clear cathodic current associated with denitrification reaction (Fig.1). The lithotrophic medium was changed to mixotrophic one by adding acetate and the EET ability was enhanced. The present finding highlighted the effectiveness of EET monitoring as a new descriptor of microbial

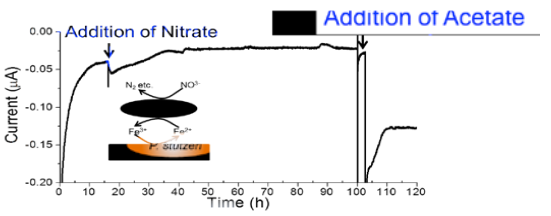

Fig. 1: Monitoring of cathodic current generated by P. stutzeri

denitrification activity and metabolic change.

[1] Canfield et al. (2010), *Science*, **330**, 192-196. [2] Straub et al. (1996), *Appl. Environ. Microbiol.*, **62**, 1458-1460.